

Card Slice approach to SpaceWire Standardized Backplane

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Glenn Rakow
NASA-GSFC
Glenn.P.Rakow@nasa.gov

Background

- Many studies have been performed to compare different avionic enclosures solutions; evaluated studies considered here were performed by
 - NASA/LaRC; NASA/GSFC; and industry proprietary studies to name a few
- Evaluated studies have shown that card slice (stackable) designs have advantages over traditional backplane enclosures
 - Less mass & volume
 - Better thermal conduction
 - Less stringent mechanical tolerances
 - Less assembly difficulties/issues
- NASA Constellation Program is currently evaluating a card slice avionic approach using SpaceWire for intra-box communications to
 - facilitate reuse between Altair (Lunar Lander) and Lunar Surface Systems (LSS) because
 - ease of disassembly and re-integration (reconfiguration of avionics boxes)
- Card Slice approach should be considered by SpaceWire Backplane WG for standardization

Card Slice Model

- Card Slice approach has a backplane but it is not implemented in the typical fashion
 - Backplane is a specific Card Slice in the avionics enclosure card stack that is
 - interconnected via a flex circuit rather than a stackable connector
 - Allows more component headroom on cards
 - Mechanical tolerances less stringent
 - Provides ability to have more choices for connectors
 - Provides ability to have better signal integrity
- Modular Architecture for Robust Computation (MARC)* has many features that are applied to this proposal
 - Active backplane, i.e., router on backplane, but use specific card slice (Common Slice) instead of backplane for this approach
 - Single supply to all board from Common Slice with Point of Load (PoL) converter on each board
 - Power switch for card slice either on Common Slice or on respective Card Slice
 - Central (common) controller and box level interface on Common Slice
 - Local FDIR for enclosure and processor resource for different card slices

* See "SpaceWire Active Backplane"; Alan Senior; 11th SpaceWire Working Group Meeting

Conclusion

- A card slice avionics enclosure using flex circuit interconnects offers many technical advantages over the traditional backplane avionics enclosure
- SpaceWire Backplane WG should consider this approach for possible standardization

End.
Thank you

Back-up

- Ratio of board level components to Printed Wiring Board (PWB) and enclosure mass is approximately
 - 1/4 for traditional backplane approach
 - Almost 1/2 Card Slice approach
- I/O connector space is larger for Card Slice approach than for backplane approach
 - Potentially 3 sides for Card Slice approach versus 1 side for backplane approach
- Mechanical tolerance for backplane connector can be difficult to match +/- .002 inches
 - X & Y (connection matching) directions
 - Z (contact depth) direction, i.e., don't want contact to bottom out but want contact to have adequate
- Backplane approach reliant upon wedge locks for thermal conduction
 - wedge locks have been susceptible to losing pre-load and hence thermal conduction and
 - "bind-up" causing difficulty when removing boards from enclosure
- Backplane is unique for each enclosure but
- Card Slice allows the ability to adapt flex circuit for different card lengths
 - multiple size flex circuits or
 - cut and terminate for specific length